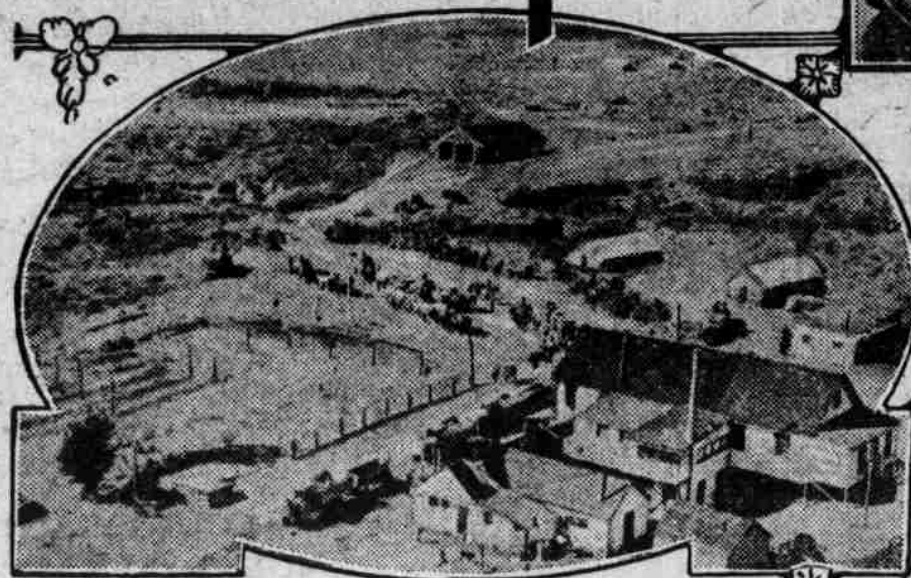


Radium: Mine To Hospital



COLORADO HEADQUARTERS

By JOHN DICKINSON SHERMAN.

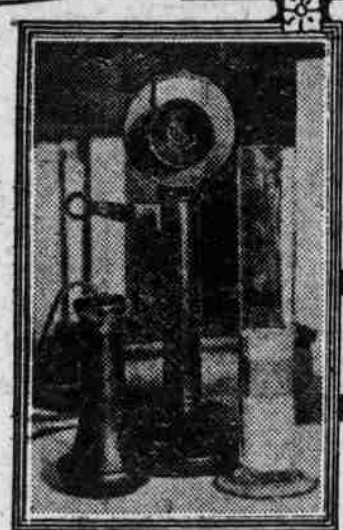
CONCERNING Mme. Marie Curie and her discovery of radium, her recent visit to the United States and the presentation to her by American women of a gram of radium in recognition of her services to science and humanity the reading public is sufficiently informed. Everybody knows that she was made much of by our dignitaries; that ten degrees were conferred upon her by our universities; that President Harding himself made the presentation to her in the White House with appropriate words in the presence of a brilliant gathering of notables, and that a tired and happy woman finally sailed away with her precious gram of radium stored in a mahogany case lined with steel and lead. She said she was going to take a real rest and that she hoped in September to go back to her work in the Curie institute in Paris—now that she again has radium to work with. The institute divides its work along two main lines. One has to do with the study of radium and radioactive substances purely from the viewpoint of the physicist; the other deals with their application to the treatment of human ailments. She will also carry on an extensive investigation of mesothorium, another radioactive substance—enough of this was presented to her to bring the value of the combined gift to \$165,000.

But where this American radium came from and how it was produced is another story, which may profitably be told in this connection. It is especially interesting, inasmuch as the total world's supply of radium is estimated at only 140 grams (a gram is one twenty-eighth of an ounce). The illustration by comparison shows how small is this amount. The lower section represents that made by the principal American radium refinery, the dark section that made by other American refineries and the upper layer that produced abroad. So, though radium was not produced in the United States till 1913, this country now has made about five times as much as the rest of the world.

While Mme. Curie, by discovering radium, introduced a new conception into the fundamental problems of existence, she actually produced very little radium, since she was denied the ores with which to work. Moreover, she gave it all away to the medical profession of Europe. A very small portion found its way to New York. In 1911 the late Joseph M. Flannery of Pittsburgh, who had made a success with vanadium as an alloy for steel, devoted his attention to the production of radium. The ores of other countries being out of the question, he turned to the carnotite deposits of southwestern Colorado. Prior to the World War this carnotite ore had been shipped to French and German producers of radium.

The mining and handling of carnotite ore in southwestern Colorado is attended with difficulties. The region is desolate and practically uninhabited. Water is scarce. Flannery had his troubles. He had to train new men. He finally established headquarters at the only spring of clear water within 100 miles; here the Standard Chemical company maintains all the offices for its mining work, transportation and supplies. Eighteen miles away the company built the largest radium concentration mill in the world, through which has passed the ore from which has been refined more than half the world's supply of radium. Burros carry the ores from the mines to the mill, and water and supplies to the miners.

Mme. Curie worked on European ores which contained about one gram of radium to every five or six tons. In the Colorado ores there is about



WORLD'S SUPPLY

one gram to every 500 tons. Moreover, the carnotite miner is a pocket hunter. Sometimes the ore appears on the surface and along rim rocks; then extraction is easy. More frequently the ore is found under a heavy overburden of other material; then regular mining tunnels are run and dynamite is used to break the rock for transportation to the surface. The pockets vary widely; some contain only a few pounds, while exceptional pockets have contained 1,800 tons.

First, of course, the pocket must be found. Prospecting is done by drilling in likely spots with jack hammers and with diamond drills. Where the overlay is not more than 25 feet deep the jack hammer, operated by portable gasoline compressors and compressed air, is the cheapest method of working. Under other conditions the diamond drill is used.

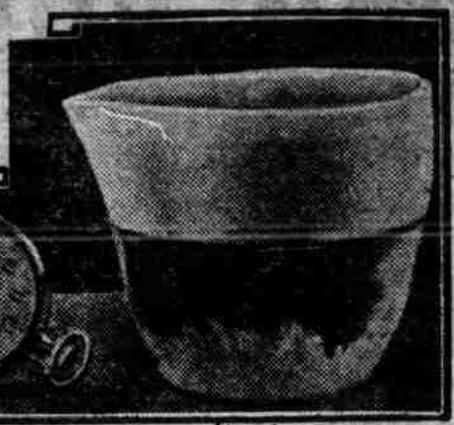
Hamilton Foley writes for the Pan American Union an interesting account of the operations of the company and of the production of the radium presented to Mme. Curie; the pictures used herewith are among the illustrations. He says in one place:

"Let us follow the various operations from the extraction of the ore to the final recovery of the radium. At the concentration mill in the wilds of Colorado 500 tons of ore are reduced to about 125 tons. In a powdered form this quantity is shipped in 100-pound sacks, by wagon and, where possible, by motor trucks, the 65 miles to Placerville, Colo. Here a narrow-gauge railroad takes it to the transcontinental railroad at Salida, Colo. From Salida it travels the 2,300 miles to Canonsburg, Pa., just outside of Pittsburgh, where the company maintains its concentration plant, No. 2.

"It should be noted that at the mill in Colorado, and in the operations pertaining to it, some 300 men are necessary to carry through all the detailed work. Also, that when the ore is taken up by the Colorado mill, there is only 1 part radium for every 400,000,000 parts of the ore; but when the ore reaches the mill at Canonsburg the proportion is 1 part of radium to 100,000,000 parts of the ore.

"The task of the Canonsburg men is to reduce this mass of ore to less than a quarter of a ton, and in such a way that whatever radium may have been in the greater mass will be found in the small residue. This is done with regularity and precision, notwithstanding that in the elimination of the 100,000,000 parts of undesirable material the Canonsburg plant has to use 10,000 tons of distilled water, 1,000 tons of coal, and 500 tons of chemicals. It should be noted in this connection that whatever small quantity of vanadium and uranium there may be in this material is saved while this final reduction is being made.

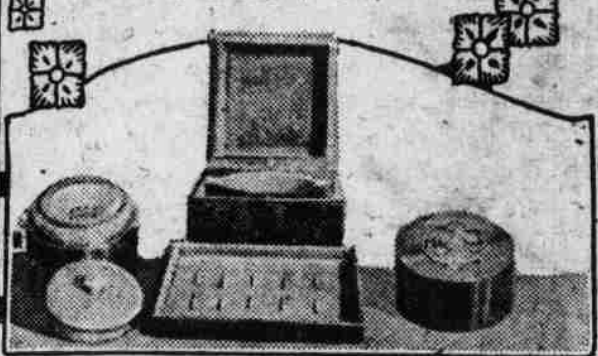
"The actual recovery of whatever radium there may be in the tons of material handled at these two great concentration plants is made elsewhere. When the 125 tons of material that reached Canonsburg from the mill in the West have been reduced to less than a quarter of a ton, this residue is sent to the radium research laboratories of the company in the form of radium barium chloride. By suc-



MME. CURIE'S RADIUM



TRANSPORTING ORE



RADIUM AND CONTAINER

cessive fractional crystallizations of the radium chloride and, at a later stage, of the bromide, most of the radium is obtained in a salt containing over 95 per cent of pure radium bromide. By still further chemical treatment the bromide is converted into the sulphate or the chloride, and in the therapeutic use of radium these two salts find the largest use."

Mme. Curie, several years ago by general request, fixed an international radium standard. This is deposited in Paris and the leading cities of the world have replicas of it. So now radium preparations are measured by comparing the electrical energy carried by their gamma rays with that of the international standard. While radium has still many mysteries, it may be said for the benefit of the general public that its energy appears to be given off in three rays, which are known as the Alpha, Beta and Gamma rays. It is stated that the Alpha and Beta rays are electrical and that the Gamma ray is rather a vibration than a ray. The Alpha ray is believed to comprise 85 per cent of radium's activity; it travels with about the speed of light and has no penetrative power. The Beta ray is about 10 per cent of the activity, travels with about 1-15 the speed of light and can penetrate about an inch and one-fifth of lead. The Gamma ray can penetrate more than three inches of lead; when it strikes a hard substance it breaks up into two rays corresponding to the Alpha and Beta rays.

It is the Gamma ray that is used in bloodless surgery. The Alpha ray does not burn. The Beta ray is kept from the patient by a screen that absorbs it. The Gamma ray seems to have the peculiar quality of picking out useless or harmful tissues for its first attack; it will harm useful tissues only after harmful tissues have been burnt away or dissolved. Radium is handled in glass tubes incased in lead containers. Those who handle it constantly usually get pretty badly burned sooner or later. Flesh burned by radium cannot be healed; it simply disappears and is gone. One of Mme. Curie's hands has been affected and her general health has been undermined by intensive wartime work with radium.

A gram of radium makes a small thimbleful. Its current price is \$120,000. A gram is divided into a thousand parts, each of which is called a milligram and sells for \$120. Physicians who use it have from 50 to 250 milligrams. The state of New York has recently purchased 2 3/4 grams for use in the treatment of cancer.

With radium worth \$120,000 a thimbleful, how is it that the dials of even cheap watches can be made luminous by its use? It's this way: The luminous material on the dial is a combination of a most minute portion of real radium and a special zinc sulphide. These atoms are so small that it would take hundreds of millions of them to cover an inch. As each atom explodes, a projectile too small to be seen under a microscope flies off and strikes a crystal of the zinc oxide. The heat generated by the impact makes a flash visible to the eye. As these explosions occur at the rate of about 200,000 a second on the watch dial, their combined flashes make the dial luminous.

IMPROVED UNIFORM INTERNATIONAL

Sunday School Lesson

(By REV. P. B. FITZWATER, D. D., Teacher of English Bible in the Moody Bible Institute of Chicago.)
(© 1921, Western Newspaper Union.)

LESSON FOR AUGUST 28

FROM ASIA TO EUROPE.

LESSON TEXT—Acts 16:6-18.
GOLDEN TEXT—And they said, believe on the Lord Jesus Christ, and thou shalt be saved, and thy house.—Acts 16:31.
REFERENCE MATERIAL—Rom. 15:15-21.
PRIMARY TOPIC—A Wonderful Dream.
JUNIOR TOPIC—Paul Crosses Over Into to Europe.
INTERMEDIATE AND SENIOR TOPIC—Beginning Work on a New Continent.
YOUNG PEOPLE AND ADULT TOPIC—Paul Carries the Gospel to Europe.

I. Forbidden by the Holy Spirit to Preach the Word (vv. 6-8).

We have here a lesson on divine guidance. The inclination of Paul and his companions was to tarry in the provinces of Asia preaching the word, but contrary to their inclination they were hurried along. They might have reasoned "What difference would it make as to where we preach; just so the Gospel is preached?" Though seemingly small, the question as to whether the Gospel should be preached among the people in the East or in the West has determined the entire history of the church. Had they preached among the people in the East, Christianity would never have become worldwide. On the other hand, by laying hold upon the Grecian intellect and combining with it the push and energy of the Romans, it became worldwide. In the guidance of the Spirit we find Him just as active and as faithful in closing doors as in opening them. "The steps as well as the steps of a good man are ordered of the Lord." We ought to as truly recognize God's hand in the "shut-ins" as well as in the "open-ings."

II. Called to Macedonia (vv. 9-12).

A vision was given to Paul of a man from Macedonia pleading for help. This was the solution of the mystery of closed doors about them. There is a negative and a positive side to the Spirit's guidance. If we will note both we shall be able to determine with a surety the proper course of action. In order to be led aright we must be sure that we are willing to be led, pray definitely for leading, and then render willing obedience as fast as the light comes. As soon as the divine way was known they rendered immediate obedience.

III. The First Convert in Europe (vv. 13-15).

The missionaries went to Philippi. The Jewish element in this city was very insignificant; so much so that they could not afford a synagogue; therefore the devout people were accustomed to worship at the river side. To this humble gathering Paul came and preached to the women gathered there. A certain woman from Thyatira believed his message, and was baptized. Lydia was a woman of wealth, culture, and wide experience, and yet she had need of Christ. The steps in Lydia's conversion are worthy of note:

1. Attendance at the place of prayer (v. 13). This is the case with most people who are saved.

2. Listened to the preaching of the word of God (vv. 12-14). The instrument used by the Holy Spirit in the conversion of sinners is the word of God. "Faith cometh by hearing, and hearing by the word of God" (Rom. 10:17).

3. Her heart was opened by the Lord (v. 14). Regeneration is a supernatural work. When the Gospel is preached the Spirit of God makes it living and active, opening the sinner's heart for the reception of Christ.

4. She was baptized (v. 15). It is natural for the one who believes in Christ to desire to be baptized.

5. Her household also believed (v. 15). Thus we see that her's was a typical conversion.

IV. A Spirit of Divination Cast Out (vv. 16-18).

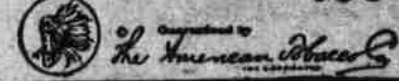
As the missionaries went out from day to day to the place of prayer they were accosted by a young woman possessed by a spirit of divination. She was owned by a syndicate of men who derived large gains from her soothsaying. This act of the woman became a great annoyance to Paul who, in the name of Jesus Christ, commanded the evil spirit to come out. Here is a case of a spiritual medium, a fortune-teller, being freed from demoniacal possession. Many men to-day are making money by the degradation of womanhood, and they resent all efforts to destroy their infernal business, even try to destroy those who interfere with their business. Here as everywhere Satan blocks the way as the Gospel of Christ is carried into new fields, but the Lord is again triumphant.



GENUINE

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Government Maintains Paid Hunters. Strange as it may appear, the government employs hundreds of hunters. The biological survey hires between four hundred and five hundred hunters whose sole duty is to hunt and trap wild animals. In 1920 these professional hunters "bagged" out 32,000 skins and scalps, divided among the various animal tribes as follows: Wolves, 584; coyotes, 27,100; mountain lions, 149; bobcats, 4,123; Canada lynxes, 43. To the average citizen of this country, especially in the thoroughly domesticated East, these figures might not convey practicability, but to the farmers of the western ranges they mean a saving in live stock of about five million dollars.

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Carefully Reared.

The business man had decided to try a girl secretary, and was interviewing applicants for the job.

He eyed, rather suspiciously, a fair young thing, who wore a V-cut blouse, a short skirt, gray silk stockings and a lot of gaudy "jewelry."

"I—er—hope you were carefully brought up?" he stammered nervously.

"Oh, rather, old bean!" replied the damsel. "Old Bill, who works the lift, is an old flame of mine; he wouldn't hurt me for worlds."

Honest, at Any Rate.

"Am I the first girl you ever loved?" "No, dearie. But I came to this resort with \$300 saved up. I'll cheerfully buy you ice cream and candy until I've spent my wad."—Louisville Courier-Journal.



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